A Leon County Mosquito Control Factsheet

Eastern Encephalitis - A Fatal Mistake

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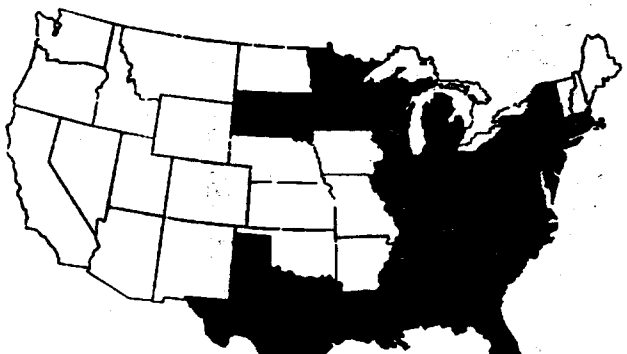
Eastern encephalitis, also called eastern equine encephalitis and abbreviated EE, is a fatal disease of humans and horses caused by a virus carried by mosquitoes. The disease occurs throughout the eastern United States and Canada from mid-July until first frost in the north, and during most of the year in Florida. Disease outbreaks are usually limited to 1-3 counties and typically occur every 5-10 years. In some locations, however, there may be horse cases every year. The virus that causes the disease is not normally found in either of these animals, thus the disease is truly an accident of nature.



Distribution of eastern encephalitis in the U.S.

Any Florida horse from Pensacola to Lake Okeechobee that is located near a freshwater swamp or marsh is at greater risk to EE. On the average there are 50-75 horse cases each year in the State. Over 90% of these animals would die if left alone. Mercifully, once a diagnosis is confirmed, most animals are destroyed.There are typically only one or two human cases each year in Florida. Unfortunately, many are fatal; and of those that do survive, nearly all have some residual effects, particularly mental impairment. There is no specific treatment or cure for EE in man or horses but there is a vaccine against the disease in horses.

THE CAUSE

The cause of eastern encephalitis is a virus called eastern equine encephalomyelitis. The virus is normally found only in wild song birds and mosquitoes that live in and around wooded swamps; not just any swamp, but a swamp where there is a certain species of mosquito. The EE mosquito or "black-swamp-mosquito" has the scientific name *Culiseta melanura* (cue-la-see-ta mel-ah-nur-ah).

The virus does not usually cause disease in wild birds, although it may cause a temperature, and perhaps a minor illness similar to a cold or flu in a human. It does not affect the mosquitoes in any way.

MOSQUITO CULPRITS

Culiseta melanura, which translates to "curly black hairs," is indeed a dark mosquito that has a very long proboscis or probe that it uses to draw blood from its hosts. *C. melanura* has very specific breeding requirements. It occurs in most states east and a few states west of the Mississippi River. The larvae are found only in the underwater root systems of deciduous trees that grow in swamps. Fortunately for us, they gets their blood from song birds; rarely does it bite humans or other mammals. And, since *C. melanura* flies no further than 5 miles from its breeding sites, most cases of EE occur within 5 miles of these swamps.

HOW DOES IT HAPPEN?

Well, if *C. melanura* doesn't bite mammals, how do horses and humans get the disease? The entire story is unknown but enough facts have been gathered to construct the following life history:

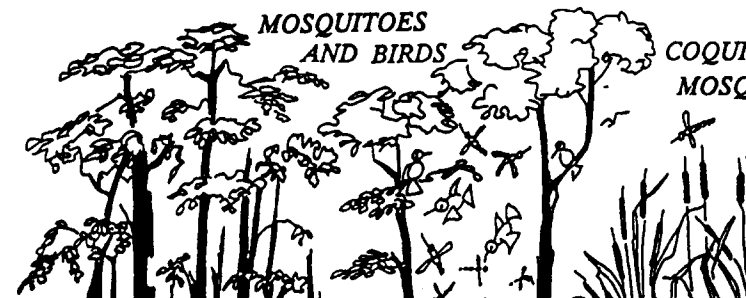
During warm months when *C. melanura* breeds, there are usually plenty of small birds around for adult mosquitoes to feed on. When female mosquitoes [males do not bite] feed on an infected bird, they pick up the virus. Later, when the mosquito blood feeds on another bird, the virus is transmitted to the new bird. The mosquito remains infected for life and can transmit virus to all birds it feeds on.

After the mosquito blood feeds, the bird becomes infected and the virus begins reproducing in the bird. In a few days, and for only 1 or 2 days, the blood of the bird contains enough virus to infect other mosquitoes that bite it. The bird quickly recovers from the infection and develops immunity. As far as we know, the immunity keeps the birds from becoming infected again. Only newly infected birds can serve as a source of virus for mosquitoes. Therefore, the mosquito seems the most important host as far as virus survival is concerned.

Since *C. melanura* does not bite people, the key to human and horse infection is tied to the short period when birds have high concentrations of virus in their blood. When other mosquitoes feed on infected birds they can become infected as well. It is these "secondary" mosquito species that carry the virus to other vertebrate hosts, including horses and humans. For these secondary mosquitoes to transmit the virus from birds to humans, an individual mosquito must successfully blood feed on both groups of animals. Not all mosquito species do that, *C. melanura* for example.

There is another species of mosquito that is most often associated with outbreaks of EE in horses and humans. This mosquito, the "salt-and- pepper mosquito," has the scientific name *Coquillettidia perturbans* (Coke-qua-la-tid-e-ah purr-tur-bans) or "cokes" for short. This is a large black and white mosquito that looks for blood around dusk. Cokes have a geographic distribution similar to *C. melanura*, but rather than breed in wooded swamps, they breed in cattail or grassy marshes that have a mucky bottom. These types of marshes are often next to the swamps that produce *C. melanura*.

There may be other mosquitoes, particularly those in the genus *Aedes* (a-e-dees), that also feed both on birds and mammals and thus could possibly transmit EE. The species of *Aedes* involved differ from area to area. Cokes are the

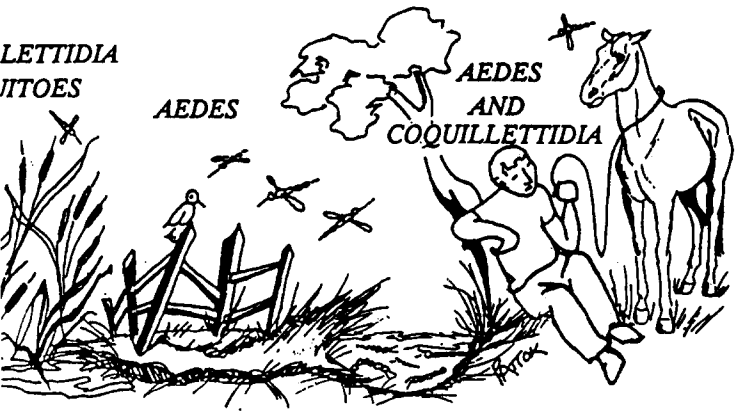


only other mosquitoes found throughout the range of EE in the United States. While cokes and *Aedes* can fly more than 5 miles, EE generally does not occur in areas where there are no *C. melanura*.

Cokes and *Aedes* can, and do, take bloodmeals from a variety of other domestic and wild animals; such as cattle, dogs, cats, squirrels, raccoons, and deer. Fortunately, these animals are resistant to the virus and do not develop EE. Of course, mosquitoes also can blood feed on birds other than wild song birds. Birds that are not native to the U.S., such as ring-necked pheasants and starlings, and some native birds,

such as whooping cranes and sandhill cranes can become ill, and many die. Die-off's of exotic birds, particularly pheasants, often precede outbreaks of EE in humans and horses.

Unlike wild birds, infected horses and humans normally do not develop high enough concentrations of virus in their blood to infect mosquitoes. This means that they are not good hosts for the survival of the virus. Once the animal recovers from the infection, or dies, the virus in that animal also dies. Animals like this are called "dead-end hosts," not because they die, but because the virus can not be perpetuated. Thus, EE in non-bird hosts is not part of the virus' normal life cycle. It's a fatal mistake for humans, horses and virus alike.



KEEPING A LOOKOUT

Many mosquito control programs in Florida use "sentinel chickens" to alert them when the threat of EE is greatest. Chickens are penned in areas where there are mosquitoes. Every two weeks, a blood sample is taken from some of the birds and tested for antibodies to the virus. Chickens seldom become ill when infected with EE virus. Sentinels were first established throughout Florida in 1978 following a 1977 epidemic of another mosquito-borne viral disease, St. Louis encephalitis (SLE). [There is an IFAS Factsheet on SLE available.] Though chicken flocks were established to monitor SLE, they also have been used to some extent for EE.

While sentinels do not forecast SLE or EE outbreaks, they do provide some limited information on virus activity. Still, the absence of virus activity in chickens does not necessarily mean there is no virus activity. Consequently, sentinel chickens can give a false sense of security regarding EE or SLE activity.

Use of sentinel flocks has been on the decline among mosquito control programs since 1983. Even the Florida Department of Health and Rehabilitative Services, which set up the system, has reduced its support in recent years.

The best system to monitor for EE is to **1)** monitor the population levels of the important mosquitoes, *C. melanura*, cokes, and man-biting *Aedes*, **2)** test these same species for virus, **3)** test native song birds for antibodies to EE virus, and **4)** establish a system to rapidly detect horse cases near the swamps. Since EE activity in a county during any given year can be limited to a single swamp among many, it is necessary to monitor these factors in all *C. melanura* breeding swamps.

Florida mosquito control programs typically have a mosquito monitoring system in residential areas. Where there is a potential for EE, the system should extend to the swamps and marshes. Testing mosquitoes and wild birds for virus activity is more expensive than sentinel chickens, but the test results are more reliable for determining the potential for an EE outbreak. Unfortunately, today's testing methods are not readily available or cost effective for mosquito control programs. Frequently, horse cases occur before human cases and are used to indicate the spill-over of virus transmission from the bird-mosquito-bird cycle to the bird-mosquito-mammal pathway.

PREVENTION AND CONTROL

There is a vaccine against EE for horses; and every horse in the state should be vaccinated

and have twice yearly boosters. On the other hand, there is no vaccine or cure for EE in humans. The only way to prevent EE in humans is by controlling the mosquitoes that carry the virus. This means controlling cokes, some *Aedes*, and particularly, *C. melanura*. Without *C. melanura*, there can be no EE in horses or humans. It is as simple as that.

It is usually not practical to spray swamps frequently for *C. melanura*, as is normally done to control other mosquitoes in residential areas. Concerted efforts to reduce mosquito populations in non-residential areas are only made after the State Department of Health and Rehabilitative Services declares an EE alert.

Aborting the threat of an EE outbreak, or an outbreak itself, is most easily done by an aerial application of insecticide to kill adult *C. melanura*, cokes, and man-biting *Aedes*. If done properly, only one or two well-timed aerial applications are needed to control the problem for a year. Where aerial application is not possible, adulticides must be applied with the normal ground based equipment used for mosquito control in residential areas.

Aedes can sometimes be controlled in the immature or larval stages, but there is currently no effective way to control larval *C. melanura* and cokes. Larval control is indicated only for prevention, not as a response to an outbreak.

NEED MORE INFORMATION . . .

. . . on Eastern Encephalitis and its control in Leon County? Contact **Mr. Gene Baker, Leon County Division of Mosquito Control, 2965 Municipal Way, Tallahassee, FL 32304, 904/487-3174.**

. . . on EE and its control elsewhere in Florida? Contact the mosquito control district in that county, or **Dr. Charlie Morris, Extension Entomologist, Florida Medical Entomology Laboratory, IFAS- University of Florida, 200 9th Street Southeast, Vero Beach, FL 32962, 407/778-7200.**

. . . regarding EE prevention in horses,? Contact your local veterinarian or **Dr. Paul Gibbs, Department of Infectious Diseases, University of Florida, College of Veterinary Science, J137 JHMCH, Gainesville, FL 32611, 904/392-9257.**

Sponsored by the Florida Medical Entomology Laboratory, IFAS-University of Florida and the State of Florida Department of Health and Rehabilitative Services, Office of Entomology Services.

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